

Composite Single Crystal Silicon Scan Mirror Substrates, Phase I

Completed Technology Project (2013 - 2013)



Project Introduction

Single crystal silicon is a desirable mirror substrate for scan mirrors in space telescopes. As diameters of mirrors become larger, existing manufacturing capabilities of single crystal silicon (SCSi) cannot supply sizes that are larger than about 450 mm in diameter. Onyx Optics proposes to develop a process based on our established technique of Adhesive-Free Bonding (AFB®) of single crystals, optical ceramics and glasses that can produce sizes that are larger than commercially available SCSi. The precision composites, consisting of SCSi components, are expected to perform as well as a single crystal. Precision grinding and polishing of large composite SCSi without subsurface damage is a desirable feature for large scan mirror substrates. As part of the proposed manufacturing process, Onyx Optics proposes to develop a technique that is based on electrolytic in-process dressing (ELID) of grinding wheels of decreasing diamond grain sizes. The process is generally applicable to ductile grinding of hard materials such as glass, sapphire, silicon carbide, silicon nitride and SCSi and is known to result in low stress components. Composite SCSi interfaces will be characterized interferometrically at 1.55 micron by their transmitted wavefront. Heat transfer measurements across bonded interfaces of SCSi will be performed at room temperature and liquid nitrogen. Equibiaxial fracture strength of composite disks will be determined and compared with control disks.

Primary U.S. Work Locations and Key Partners

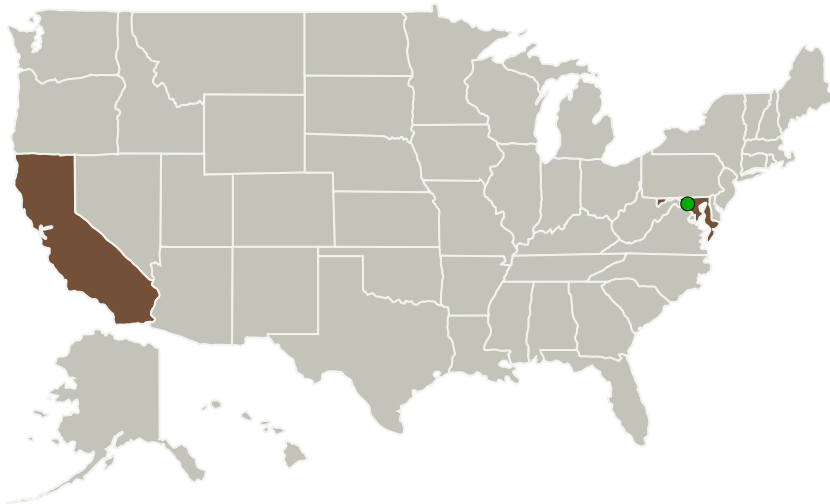


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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Onyx Optics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

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Organizations Performing Work	Role	Type	Location
Onyx Optics, Inc.	Lead Organization	Industry	Dublin, California
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

California	Maryland
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Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138054>)

Images

Project Image

Composite single crystal silicon scan mirror substrates
(<https://techport.nasa.gov/image/130187>)

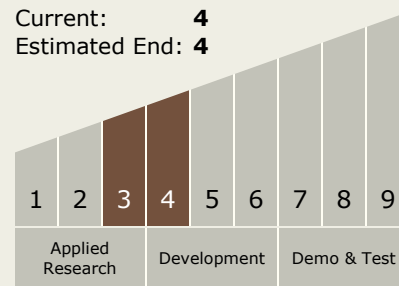
Project Management
(cont.)

Principal Investigator:

Xiaodong Mu

Technology Maturity
(TRL)

Start: 3
Current: 4
Estimated End: 4



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - TX08.2 Observatories
 - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System